



THE WARRIOR

U.S. Army Soldier Systems Center

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Soldier 2025 storms ahead

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Cover photo: Sgt. Joe Patterson aims a model arm-mounted individual weapon, which is part of the mock-up outfit of Soldier 2025. (Warrior/Underhill)



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Arming soldiers with nutrition

By Jane Benson
Staff Writer

Scientists in the Department of Defense (DoD) Combat Feeding Program are working to ensure that the soldier of the future has plenty of nourishment within arm's length.

Although the product is still planted in the conceptual phase, scientists are working on a nutritional patch called the Transdermal Nutrient Delivery System (TDNDS) that would be used by warfighters under extreme circumstances.

The system would conceivably expand on the osmotic technology of the nicotine patch that is worn on the arm. However, instead of transmitting nicotine, this patch will transmit vitamins and nutrients needed by the human body. The patch would be used to keep the warfighter at optimum performance for

a day or two, until he or she has access to a real meal and the time to eat it.

Gerald Darsch is the joint project director for the DoD Combat Feeding Program, which is part of the Natick Soldier Center at the U.S. Army Soldier Systems Center (Natick).

"TDNDS would be used during periods of high-intensity conflict," Darsch said. "It is not intended to ever replace a turkey dinner with all the fixings."

Darsch explained that the patch's ingredients could also include nutraceuticals, which are food components with a pharmaceutical action above and beyond normal nutrition. These chemicals could tell a hungry soldier's brain that his stomach is full or reduce combat-related stress, such as muscle fatigue and physical problems associated with prolonged

cold weather exposure and high altitude. In the future, the patch could possibly transmit nutrients in one of several ways.

According to Darsch, a microchip processor would interact with sensors to determine a warfighter's metabolic requirements. The processor would then activate a microelectrical mechanical system to transmit the micronutrients.

Nutrients would be transported via skin pores that have been opened by electrical impulses, or through microdialysis, which would pump nutrients directly into blood capillaries.

Another potential vehicle for transport could involve controlled release of encapsulated nutrients through the skin.

Dr. C. Patrick Dunne of

"It is not intended to ever replace a turkey dinner with all the fixings."

Gerald Darsch,
DoD Combat
Feeding Program

the DoD Combat Feeding Program, said that the patch has civilian, as well as military, applications. In the future, the patch could be used by workers in a variety of stressful, hazardous work environments.

For example, the patch could potentially be used by miners, oil rig workers, firefighters, chemical production or cleanup workers, as well as by astronauts involved in space walks or space station repair.

However, Darsch pointed out that TDNDS is still an early concept.

"Will the TDNDS be achievable as we envision it today? Maybe not. Are we investing heavily in it today? Absolutely not," he said. "Nevertheless, it has been said the best way to predict the future is to invent it. Natick has already received calls from several world-class companies to begin to explore a partnership to determine the feasibility of this concept."

Pending significant technological breakthroughs, Darsch estimated that the system could be available to military personnel around the year 2025.



Graphic by Steve Smith



Warrior/Underhill

Sgt. Joe Patterson, an enlisted advisor at Natick's Operational Forces Interface Group, models Soldier 2025. The uniform acts as a "data bus," transporting data from areas such as the wrist-mounted weapon.

Soldier 2025

New technologies anticipated for the future warfighter

By Jane Benson

Staff Writer

While many people may have been busy preparing for the year 2000, the U.S. Army Soldier Systems Center (Natick) has been busy envisioning and inventing technologies that will better protect the warfighter of the year 2025.

Led by Bob O'Brien, a team of Natick scientists and engineers has come together to brainstorm future warfighter systems. The team anticipates that the soldier of the future will don a multifunctional uniform constructed from smart, interactive textiles and other materials.

Such materials will be able to sense and react. For example, the warfighter of 2025's uniform will be able to sense the warrior's surroundings and change color to blend in with the environment, or detect and re-

pel chemical agents. The uniform will also act as a "data bus," passing data and information from, for example, a wrist-mounted weapon to the helmet-mounted display.

"Soldier 2025 takes technologies that we're working on today one step further," said Robin St. Pere, team member at Strategic Communications.

Advances in nanotechnology will also benefit the soldier of 2025. Nanotechnology is the ability to manipulate materials on an atomic or molecular scale. This technology will improve the strength and durability of textile fibers, which will lead to vast improvements in ballistic protection for the soldier.

As a result of material advances, the soldier of 2025 will wear a helmet that is 40-60 percent lighter for protection against fragmentation threats. In addition to providing pro-

tection against shrapnel, it is anticipated that new materials will permit a bulletproof helmet to be developed that is somewhat heavier.

The helmet is expected to protect the soldier's face and eyes from all threats, including environmental, energy, chemical, biological and ballistic. Nanotechnology is also expected to permit sophisticated capabilities to be included in the headgear subsystem. The subsystem will include a high-resolution display giving warfighters the ability to view tactical/situational data, maps and chemical/biological areas.

The headgear's integral communication system will make it possible for a warfighter to transmit and receive information from his squad, other squads, his command group, remote sensors or even unmanned aerial vehicles performing reconnaissance.

Soldier 2025 will possess a microclimate conditioning subsystem incorporated into his belt. The mechanism will warm the soldier in cold weather and cool him in warm weather.

The future warfighter will benefit from a physiological status monitoring system, which will keep track of information such as whether the soldier is dehydrated or sleep-deprived. The data would then possibly be transmitted to a medic, unit commander or both.

These are just a few of the ideas proposed at Natick. Some of these concepts may come to fruition as originally envisioned. However, inventing is a process of trial and error, and some products mentioned here may be altered and reconfigured along the way to best serve the soldier of the future.



Warrior/Underhill

The skin temperature sensor is part of the physiological status monitoring system and is located on the soldier's arm.



Warrior/Underhill



Warrior/Underhill

A vest worn by Soldier 2025 holds rocket rounds while a bayonet remains part of the carrying load. Soldier 2025 will possess a microclimate conditioning subsystem incorporated into his belt.

Home cooking

Marine Corps kitchen brings garrison amenities to the field

By Curt Biberdorf
Editor

Home cooking takes on new meaning with the Marine Corps Rapid Deployment Kitchen.

Developed by the Department of Defense Food and Nutritional Research Program at the U.S. Army Soldier Systems Center (Natick), the kitchen allows cooks to prepare perishable and shelf-stable ration meals in the field with many of the conveniences found in a regular kitchen.

"The application is typical of what you'd find in garrison," said Mario Lucciarini, project officer of the Systems Equipment and Engineering Team, Natick Soldier Center.

The kitchen is a hard-shell, container-based facility measuring 8 feet by 8 feet by 20 feet, expandable on both sides. Designed to support assault echelons and maneuver elements of Marine air ground task forces, it's highly mobile and rapidly deployable with the capability of serving a minimum of 650 Marines two meals daily.

Used during a long-term deployment, it takes one hour to set up the kitchen and another 90 minutes to



Warrior/Biberdorf

Three kettles and a food preparation sink with hot water from a tankless hot water heater are located on one side of the kitchen.

serve troops a meal.

Currently, Marine cooks use a tent-based kitchen with multiple gasoline-powered burners. The new kitchen also cuts the amount of cooks necessary to operate a field kitchen from 12 to five, according to Lucciarini.

Master Chief Petty Officer (Ret.) Dave Dillon, an equipment special-

ist for the Systems Equipment and Engineering Team, spent 28 years in Navy food service and knows the rigors and drawbacks of field food preparation.

He described the rapid deployment kitchen as the flagship of military field kitchens.

"We had mess tents that were generally cold and very time consuming to set up," Dillon said. "You worked on the ground, in the muck, where everything was wet."

He said gasoline burners could accidentally explode, a safety hazard removed with the new kitchen.

"With this kitchen, we've increased sanitation, and we're able to prepare more complicated meals," he said. "I've cooked with it. No special cook skills are needed to operate it."

In the field, cooks were limited to B-rations, mainly dried products that needed to be hydrated, but the new kitchen will allow cooks to prepare A-rations, which include fresh or frozen meats and vegetables.

The kitchen is a new concept in field food preparation. While other field kitchens use electric or gasoline M2 burners, the rapid deploy-



Warrior/Biberdorf

A double-stacked convection oven, skillet and griddle are available for cooks on the other side of the kitchen.



Warrior/Biberdorf

A safety switch on the wall cuts off power to the burner in case of an emergency.

ment kitchen uses a state-of-the-art low-pressure energy transfer system similar to a hot-water-type home heating system.

A single commercial oil burner heats a food-grade mineral oil to 450 degrees, and the heated fluid is then circulated to the appliances with a pump. Commercial appliances adapted for this technology are configured with double-wall plates, similar to radiators, where the fluid circulates. A thermostat cycles the burner on and off to maintain fluid temperature, and temperature controls on the appliances cycle valves open and closed to maintain the appliance temperatures.

"There's no guessing on the cooking temperatures and no open flame. There's no need to learn another system because of the safety hazards of gasoline burners. Safety with this kitchen is unparalleled," Dillon said.

The commercial burner is powered with the standard battlefield fuels of

diesel, JP-8 or kerosene. Safety switches on both sides instantly cut off power if necessary.

It has a fuel efficiency rating of 80 percent vs. 20 percent in the other field kitchens that have burners, such as the containerized kitchen or mobile kitchen trailer, and has the low power requirements of a 10-kilowatt tactically-quiet electric generator. The high efficiency translates into fuel savings and less kitchen heat.

The kitchen has a ventilation system over the appliances; appliances use 75 percent of the heat while the remaining 25 percent escapes out a chimney.

It has fewer parts than other field kitchens, which means high reliability, low operating costs and low maintenance, and it's powerful. For example, kettle water takes less than 15 minutes to boil.

Equipment inside includes a 30-cubic-foot refrigerator, 3 foot by 2-foot griddle, a skillet, three kettles and a double-stacked convection oven.

A hand wash sink and two well

food preparation sink are supplied with continuous hot water from a tankless water heater. Accessed from the outside, the mechanical room contains a circulating pump, burner and heat exchange. It's vented, and has fire-resistant and sound-deadening walls. The kitchen can be powered directly by a generator or by plugging into an outside electrical source.

Meals are served like a dining facility in a garrison environment. Tents can be complexed next to the kitchen to create a dining area.

Operational testing was conducted at Natick and by the manufacturer. Technical testing was performed this summer at the Aberdeen Test Center at Aberdeen Proving Grounds, Md.

More testing is scheduled for Camp Lejeune, N.C., in the spring of 2000. The Marine Corps plans on procuring 85 rapid deployment kitchens.

"We're giving the Marine cooks an atmosphere where they can feel good about themselves," Dillon said. This field kitchen can combine the comforts home cooking together with the quality of home cooking.

"(Meal preparation) in the rapid deployment kitchen is only limited by the supply of food. To me, as a cook, that's very exciting."



Warrior/Biberdorf

Dave Dillon, an equipment specialist for the Systems Equipment and Engineering Team, stirs a kettle of beef stew in the kitchen.

Chapel blesses base camps

By Curt Biberdorf
Editor

They have been held in dining facilities, vacant tents or even outdoors under trees. Worship services at an Army base camp have sometimes been a take-what-space-you-can-get event until the introduction of the Containerized Chapel.

"Until now, all you had was a chaplain with a chaplain's kit on his or her belt. Then that chaplain would have to find a place to conduct worship," said Chap. (Maj.) Ben Richardson, U.S. Army Soldier Systems Center (Natick) chaplain. "They had to conduct worship wherever space was available."

The Containerized Chapel, developed by Natick's Product Manager-Soldier Support, is a



Courtesy photo

Contract employees set up the Containerized Chapel at Camp Monteith in Kosovo.

package of equipment that provides a multi-functional chapel for a 550-person base camp. The concept grew out of the needs identified in the past several years for long-term stability and support operations in Haiti, Somalia, Bosnia, Albania and Macedonia.

The Containerized

Chapel is similar to the chapel found at Force Provider — the Army's containerized, highly deployable "city" — but there was no way of taking out one component and using it now for troops deployed in Europe, he said.

Following a request from units serving in

Kosovo in support of Task Force Hawk, two prototypes were ordered. Product Manager-Soldier Support staff assembled them, and they were shipped to Camp Bondsteel and Camp Monteith. By September, the chapels were operational. The entire process lasted two months.

In addition to having no place to call a worship home, chaplains didn't have a complete set of equipment to meet the needs of various faiths until now.

Each Containerized Chapel is transported in a steel container deployable by air, sea or land. Inside is a tent with complete power generation, lighting, electrical distribution, climate control and seating for 100 people. Equipment such as lecterns, altars, linens, candles, a cross, a crucifix, offering plates, communion sets and several versions of the Bible are included to support Protestant and Catholic faiths. Jewish and Islamic supplies include chaplain kits, yarmulkes, kufis, kimaras, prayer mats, Torahs and Korans.

The Army supports the free exercise of religion for everyone, and the Containerized Chapel elevates religious support to a new level.

"We've always had items to accommodate the Jewish faith. Now the Muslims are really tickled because of the items to support them," Richardson said.

Other items included are a portable PA system, electronic keyboard, digital hymnal capable of playing up to 5,500 worship songs, 180 days of con-



Courtesy photo

Inside the Containerized Chapel is a tent with complete power generation, lighting, electrical distribution, climate control and seating for 100 people.



Courtesy photo

An altar, lectern, linens, candles, crucifix, hymnals and electronic keyboard are included in the Containerized Chapel to support Christian faiths.

sumable supplies (such as communion wafers and juice), TV/VCR, microwave oven, coffee pot and folding tables.

It's so complete, all that's missing are the chaplains and chaplain assistants.

"The Containerized Chapel is light-years better than a GP medium (tent)," said Chap. (Maj.) Allen Kovach, a Task Force Falcon chaplain. "Having such a chapel somehow brings more people into worship."

Increased attendance has meant a surge of new events and services, including crisis counseling debriefing sessions, added Richardson.

Richardson said he was mystified by not only how quickly the chapel was fielded, but also by how he hasn't heard one comment about missing items. "PM-Soldier Support was very meticulous to ensure that every item requested or required was included," he said.

Moreover, research and development wasn't scheduled until fiscal year 2001.

The Containerized Chapel team is composed

of Richardson, Dave Carney, Scott Mannka, Robert Graney and Sgt. Michael Stephenson.

"This team broke all records to design and produce a quality item in record time," Richardson said.

Beyond the two prototype chapels already in service in Kosovo, the plan is to procure and store 40 Containerized Chapels in Operational Project Stock.

Operational Project Stock is a system of prepositioning Army equipment for rapid deployment

with a minimum logistics burden. Deploying units would be able to borrow the Containerized Chapel from the inventory instead of possessing their own, according to Maj. Andy Ramsey, assistant product manager for field services, Product Manager-Soldier Support.

One chapel would be stationed at the U.S. Army Chaplain Center and School in Fort Jackson, S.C.; the Joint Readiness Training Center, Fort Polk, La.; the National Training Center, Fort Irwin, Calif.;

and the Combat Maneuver Training Center, Hohenfels, Germany, for unit ministry teams to learn, operate and maintain them.

"As an Army, we generally don't send troops somewhere for a week or two. We send them for several months at a time," said Richardson. "It's possible to scrounge for worship space for a week or two, but not for months. (The Containerized Chapel) fits into the Army's new operational tempo."

Many times exercises don't have high attendance because they can't adequately simulate the fear factor, said Richardson. When troops deploy to a remote overseas location wearing their flak vests, carrying loaded weapons and feeling fear, the attitude changes. Chapel becomes a source of reassurance in stressful times.

"To me, those are the things where you can't quantify the value," said Richardson. "If it helps settle the soldier's mind and help him to do his job, how do you put a value on that?"



Courtesy photo

Jewish and Islamic supplies in the Containerized Chapel include chaplain kits, yarmulkes, kufis, kimaras, prayer mats, Torahs and Korans.

Calculating capsule

Pill monitoring system broadens heat, cold stress research

By Curt Biberdorf
Editor

Using an ingestible pill and a receiver, research physiologists at the U.S. Army Research Institute of Environmental Medicine (USARIEM) are measuring core body temperatures in studies aimed at protecting service members from heat and cold stress.

Available initially in the 1960s, the body temperature pill system is an accurate, reliable and comfortable alternative to rectal and esophageal monitoring systems, according to Dr. Reed Hoyt, a research physiologist in the Thermal and Mountain Medicine Division of USARIEM, an installation partner at the U.S. Army Soldier Systems Center (Natick).

Besides the discomfort, rectal and esophageal temperature measuring requires a wire connection between the sensor and monitoring device, limiting their use to laboratory studies. Other measuring devices placed under the tongue, in the ear or under the armpit can be inaccurate during field testing, Hoyt said.

Initially, the temperature pill was also limited to the laboratory, but in 1995, USARIEM researchers developed a new receiver that allowed accurate and unencumbered research studies.

In a separate study in 1997, researchers conducted a lab experiment that validated the accuracy and reliability of the core body temperature pill system.

"Now that the receivers have gotten progressively smaller, lighter and less power-hungry, it's allowed us to make core temperature measurements in areas where it wasn't possible before, such as in the field," he said.

Since the mid-1990s, use of the core body temperature pill monitoring system has become widespread.

"This gives us a tool to monitor the soldiers in the field under real conditions," said Dr. Andy Young, also a research physiologist at USARIEM. "It lets researchers get

research-quality data without altering what (the test subjects) are doing. They can do their job, and we can get the data later."

Wrapped in a white medical-grade, silicone-based coating and measuring less than one inch long by one-half inch wide, the Food and Drug Administration-certified core body temperature pill looks like a fat capsule. It's composed of a battery, antenna and crystal embedded in medical-grade epoxy.

Test subjects swallow the pill,

where it remains in the stomach for about four hours before traveling into the intestine. The pill transmits an ultra-low powered signal to a receiver, which is about the size of a thick pack of cigarettes, carried on the test subject's belt. The receiver converts a subtle change in frequency into a temperature reading, which is continuously recorded and stored in the unit for wireless or computer plug-in retrieval and analysis. HTI Technologies, Inc. in Palmetto, Fla., manufactures the pill, and



Warrior/Biberdorf

Sgt. Joe Patterson holds the core body temperature pill and monitor. The system allows researchers to accurately conduct heat and cold studies without disrupting the test subjects.

FitSense Technology in Wellesley, Mass., builds the receiver.

“(The pill) just passes through you like roughage in about two days and has been used extensively without adverse effects,” said Hoyt. “Each pill costs \$40, and they’re not reused.”

NASA funded the first development work, which was performed at Johns Hopkins Applied Physics Laboratory in Baltimore.

The development of the core body temperature monitoring system at USARIEM was funded with the assistance of Defense Advanced Research Projects Agency and from the U.S. Medical Research and Materiel Command (MRMC). Studies with the pill are part of ongoing Warfighter Physiological Status Monitoring program within MRMC, according to Hoyt.

Monitoring the safety of soldiers, Marines or even firefighter — who are all operating under thermally stressful conditions — is the primary use for the temperature pill.

Some of the ways researchers have used the temperature pill include studies to validate the immersion limits safety table used by the U.S. Army Ranger Training Brigade, assessing the risk of hypothermia during Marine Corps recruit basic training and determining the rate of cooling during sleep in Marines in a cold-weather field exercise. Information can be used to change training doctrine by allowing, for instance, soldiers more food, extra clothing, more sleep, less time in a body of water or better sleeping bags.

In his 1998 space shuttle mission, Sen. John Glenn used the temperature pill and USARIEM-developed receiver to participate in research studies on sleep, aging and space travel on the body. The temperature pill showed that astronauts overheat during re-entry, which may lead to an improved space suit design, added Hoyt.

Researchers most recently used the core body temperature pill in a laboratory study of how Navy personnel might respond if a submarine was disabled.

The system costs about \$2,000 per unit. Each pill requires calibration, but a new generation of the temperature monitoring system may be

on the way in the next few years. The upgraded pill would incorporate a microprocessor to self-calibrate the measurements sent to the receiver, send out an identification code so that researchers know who is being monitored and eliminate mixed signals in the receiver, Hoyt said.

In addition to helping shape training doctrine now and in the future,

the temperature pill may also someday be used operationally.

“Ultimately, we’d like to use this in real-world conditions,” said Young. “It can tell us when soldiers need to take off their MOPP gear and rest, or tell the life guard to get out of the water.”

“We have such a low tolerance for casualties that we want a high level of safety,” Hoyt said.

Pill monitors core temperatures during study of conditions aboard disabled submarine

By Curt Biberdorf
Editor

What happens to crew members when their submarine loses power and becomes disabled was the focus of an 11-day study conducted in December at the U.S. Army Research Institute of Environmental Medicine (USARIEM), an installation partner at the U.S. Army Soldier Systems Center (Natick).

At the start of the simulated condition, the oxygen level was instantly reduced, as it is normally aboard submarines, to suppress a fire hazard.

Later, to simulate what would happen if the sub became disabled, the temperature slowly dipped to match what would be the surrounding water temperature at the bottom of the ocean.

In such conditions, humidity rises to 98 percent, carbon dioxide climbs to 50 times its normal level and the temperature inside the submarine cools to 39 degrees, said Dr. Andy Young, a research physiologist at USARIEM who is leading the study.

Research participants used the core body temperature pill system to continuously monitor their cooling and warming patterns. Temperature monitoring served several purposes.

“We want to find out how cold they get, and if they get too cold, we’d have to stop the experiment,” Young said. “We also need the data to possibly explain other

effects. For instance, if they get very cold, they might shiver and produce extra carbon dioxide.”

In place of using a rectal probe to monitor body temperature, the seven research volunteers used the core temperature pill and wore a small receiver to record the numbers.

“It allows them to go about in a much more normal lifestyle, and we’re still able to get an accurate temperature from the guys,” he said.

Five of the research volunteers were submariners. The other two were a Navy research diver and a Navy medical student. Using the temperature pill was easy, according to Petty Officer Second Class Daniel Parks, who’s assigned to the submarine school in Groton, Conn.

“You just swallow it. We weren’t concerned that it was going to cause any problems unless we chewed it,” Parks said. “We just had to make sure the receiver remained within 18 inches of our body.”

In a chamber simulating the disabled submarine in the basement of the USARIEM building, the test subjects were dressed for the conditions and lived as normally as can be expected.

Food was also supplied to replicate what would be consumed on a submarine under those conditions.

“They’re pretty good about checking our temperatures every hour,” said Parks. “They’re really good about checking our safety.”

Offering the comforts of home while enhancing operational readiness, the Army activates a base camp training facility called ...

Force Provider

Product Manager - Force Provider, the Army's "master builder of deployable cities," activated a state-of-the-art training and test facility during a ceremony Nov. 29 at the Joint Readiness Training Center, Fort Polk, La.

Force Provider is the Army's premier base camp for deployed troops. The concept was born in 1991 because of inadequate living conditions for U.S. soldiers during operations Desert Shield and Desert Storm. Gen. (Ret.) Gordon R. Sullivan, then Chief of Staff of the Army, directed the development of a containerized, highly deployable "city" that is capable of supporting troops in any environment.

The \$5.4 million complex will accommodate rotational units training at JRTC, while allowing Force Provider-designated quartermaster companies to train on the mission-related tasks of setting up, operating, maintaining, sustaining and tearing down a base camp.

The establishment of the Force Provider Training and Test Facility at JRTC is the result of a partner-

ship between the U.S. Army Materiel Command, U.S. Army Forces Command, and U.S. Army Training and Doctrine Command. It represents the Army's only permanently-operated Force Provider base camp in the world.

"This partnership is committed to providing soldiers the best training and equipment available anywhere," said Brig. Gen. J.A. "Yogi" Mangual, deputy of acquisition and readiness for the U.S. Army Soldier and Biological Chemical Command, and commanding general of the U.S. Army Soldier Systems Center (Natick). "Force Provider modules will improve our soldiers' quality of life and enhance the operational readiness of all units as they execute their mission anywhere in the world."

Missions for Force Provider include rest and refit for combat-weary soldiers, theater reception, intermediate staging base redeployment and base camps for other military operations — such as humanitarian and disaster relief — and peacekeeping missions.

"Force Provider leads the charge in providing quality bare-base life support for our warriors," said Lt. Col. Micheal E.P. Davis, product manager for Force Provider.

The product management office is based at the U.S. Army Soldier Systems Center (Natick). The Army has tasked Product Manager - Force Provider to build and assemble 36 modules by fiscal year 2003.

The facility also will be used to test and evaluate new and existing life-support systems designed to sustain and improve the quality of life for deployed soldiers in the field. According to Davis, this capability should reduce the acquisition process for fielding some equipment by three to five years and cut research, development, test and evaluation costs by as much as 25 percent.

"I think we can truly say that Force Provider is not only the best that our Army has seen, but the best in the Department of Defense," said Maj. Gen. John C. Doesburg, commanding general of the U.S. Army Soldier and Biological Chemical Command.



Courtesy photo

The \$5.4 million Force Provider training module is capable of supporting 550 soldiers and 50 base camp operators during unit rotations at Fort Polk, La.



Courtesy photo

Quartermaster soldiers set up a Tent, Extendable Modular Personnel (TEMPER) during the construction of Force Provider at Fort Polk, La.

In the event of a contingency requiring Force Provider, one of the first units that will deploy to operate a base camp is the 488th Quartermaster Company (Force Provider). The unit relocated from Fort Bragg, N.C., to serve as "training cadre" for the compound, while supporting the 142nd Corps Support Battalion and Warrior Brigade at Fort Polk.

"Their mission is to become the Army's expert in managing Force Provider operations," said Col. Gregory Lynch, commander of the Warrior Brigade.

One of the 488th QM Company's primary responsibilities is to train four other Force Provider companies in the reserve component. These units are the 216th Quartermaster Company in Mankato, Minn.; 542nd Quartermaster Company in Erie, Pa.; 691st Quartermaster Company in Los Alamitos, Calif.; and 802nd Quartermaster Company in Columbus, Ga.

Force Provider offers high-quality living conditions featuring advanced laundry, shower, latrine, kitchen and billeting systems, as well as religious and morale, welfare and recreation facilities. The entire Force Provider base camp is environmentally controlled, supporting temperatures between minus 15 and 120 degrees.

"Just about anything that's on an Army installation, you can find here," said Capt. Mark Evans, commander of the 488th QM Co. "We offer complete service for the soldier."

These logistical luxuries are like a "little slice of home for our de-

ployed soldiers," said Mike Hope, engineer for Product Manager - Force Provider.

Each module is a containerized, rapidly deployable system that can be transported by land, sea or air. A Force Provider module is typically established on 10 acres of land. On average, it takes three to four days to prepare a site, then five to six days to set up the base camp and make it fully operational. A single module is capable of supporting 550 soldiers and 50 base-camp operators.

"The (company) commander is essentially the mayor of a small city when everything in Force Provider is set up," Lynch said.

Force Provider modules may be repositioned at key locations for rapid response to contingencies

around the world. The first Force Provider module served as a base camp for troops participating in Operation Sea Signal at Guantanamo Bay, Cuba, in July 1994. In November 1995, six Force Provider modules were deployed to Bosnia in support of Operation Joint Endeavor.

"The U.S. Army and this country have the best soldiers in the world, and they're trained to fight and survive in austere conditions," Davis said. "But once they finish their missions, we owe them all the support systems that we can give them to improve their quality of life. Force Provider is a place where soldiers can rest and relax, and feel like they have many of the comforts of home. It helps them recuperate quickly, so that they can continue to execute their missions in those harsh environments."

The JRTC base camp is dedicated to the memory of Thomas J. Sullivan, who passed away in July 1998. As a senior logistics management specialist, Sullivan was instrumental in developing the first Fort Provider modules in 1994. His family participated in a ribbon cutting during the ceremony, which took place two days before what would have been Sullivan's 65th birthday.

"There's a lot to be proud of," said Brendan Sullivan, the youngest of Sullivan's three children. "It's really outstanding, the work that Dad and the Force Provider team were able to accomplish."



Courtesy photo

Surviving family members of Thomas J. Sullivan, a key member of the Force Provider team, attended the dedication ceremony.

Balancing act

Thermoelectric fan directs warm air where it's appreciated

By Curt Biberdorf
Editor

Just seconds after being placed on top of a fired-up Space Arctic Heater, the blades of the thermoelectric fan silently spun to life and evenly distributed warm breezes inside a small storage shack.

Heaters in uninsulated structures, such as tents or barracks, have the inherent problem of unbalanced warmth since heat rises to the top.

The thermoelectric fan, developed and tested by the U.S. Army Soldier Systems Center (Natick), has solved this problem.

"Before this, soldiers had to huddle around the heater to stay warm," said Joe MacKoul, project engineer at Natick's Product Manager-Soldier Support. "At times there is a more than 100-degree difference from the top to the bottom of a tent. With the fan, floor temperature increases 20 degrees or

more and pushes heat into every corner."

He said the Army has a unique requirement to run equipment without electricity. Instead of using an outside electric power source, the fan converts a small amount of a heater's energy into electricity through a thermoelectric module, which turns the fan blades.

Army space heaters are capable of operating with many types of liquid or solid fuels, such as diesel, jet fuel, wood or coal. The fan was designed for use with all four of the Army's space heaters, but it can operate on any flat surface heater with a surface temperature ranging from 500-700 degrees.

"For people who are in remote areas in a cabin or otherwise don't have electricity, they could also benefit from the fan," MacKoul said.

The goals for the Army's Family of Space Heaters are to replace World War II heaters, overcome safety hazards, distribute heat better, and meet the requirements of new tents and materials developed since the 1940s and 1950s. The thermoelectric fan fits into the space heater family by efficiently using the heater's warmth.

Besides raising the living conditions in tents, testing has proven the fan cuts fuel bills by as much as 50 percent because better heat distribution puts the heat where its needed and decreases the fuel-use rate. Tests have shown that in severe cold-weather locations \$450 could be saved each season in a 10-man Arctic tent and \$2,800 could be saved in a general-purpose medium tent equipped with two heaters and two thermoelectric fans.

MacKoul said fuel savings from one heating season could pay for the fan, which costs \$600 but should sell for \$450 as production increases.

Starting with rough early designs of various bulky shapes, the final product turned out to be a compact and portable unit. It measures 14 inches in diameter and 10 inches high, weighs 10 pounds and shows



Warrior/Biberdorf

A thermoelectric fan sits atop the Space Heater Arctic. The fan is powered by a space heater's warmth and operates with little noise.

a footprint — the area that actually touches the heater — of 4.5 inches in diameter. Fan speed increases with the amount of heat emitted from the heater, and it is capable of circulating 450 cubic feet of air per minute.

The power generation subsystem has no moving parts and is highly reliable. The motor is rated for heavy-duty operation and is designed to operate continuously for many heating seasons. Additionally, the whole unit is maintenance-

free over this period.

A wire grille prevents accidental contact with the blade. To protect the fan during transport and from moisture, each fan comes with a steel carrying case with a tight-fitting lid. Both the case and fan have a handle for easy carrying.

Testing of the fan was conducted by 1st Battalion, 17th Infantry and 41st Engineering Battalion at Fort Wainwright, Alaska. Soldiers overwhelmingly endorsed the fan, according to survey comments.

They felt a significant increase in warmth at the bottom of the tent, which improved sleeping conditions, and also liked its ease of operation. They concluded that the fan is well worth taking to the field.

Fielding began in March 1999 with the free distri-

bution of 90 fans to Army units in cold-weather locations. The Soldier Systems Center is currently initializing a purchase of about 400 fans for inventory.

Aspen Systems, Inc., in Marlborough, Mass., manufactures the thermoelectric fan.



Warrior/Biberdorf

Joe MacKoul places the thermoelectric fan on top of the Space Heater Arctic.



Warrior/Biberdorf

Stored in a protective carrying case, the fan is compact, lightweight and easy to transport.

Vapors melt grime from kitchen equipment

By Jane Benson
Staff Writer

The U.S. Army Soldier Systems Center (Natick) is investigating the possibility of using dry vapor cleaning technology on military kitchen equipment.

Dry vapor cleaning systems offer several advantages over conventional methods for cleaning stubborn contaminants, such as burnt-on food products, caked-on grease, carbon or dirt.

By relying on a combination of moisture, heat and pressure, the system requires no harsh chemicals and

no demanding manual labor.

The light, portable cleaning machine emits superheated, high-pressure steam. The heated vapor can penetrate small cracks and crevasses, unreachable by other cleaning methods.

"The system is easy to use and is safer than standard steam cleaners," said Herman Miller, project officer at the Natick Soldier Center.

The machine has been used to clean Army field-feeding equipment such as ovens, exhaust hoods, griddles and pans that are provided for Mobile Kitchen Trailers.

It restores the metal to a shiny

luster without any lingering chemical residues.

"The equipment is effective and environmentally friendly," said Miller. "In addition, dry vapor cleaning helps stop the spread of disease, because it destroys bacteria, mold and organisms. It is ideal for not only military missions, but humanitarian relief missions as well."

The dry steam sanitizer is also an economical choice for cleaning military kitchen equipment.

The system is a commercially-available product and requires no further expenditures for research and development.